

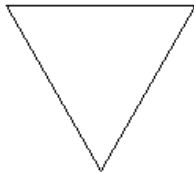
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## INVESTIGATING ESCHER'S TESSELLATIONS

Once students have experience with creating tessellating art, they are ready to learn other ways to create these symmetrical patterns. To begin, I review the regular tessellations and introduce other tessellating polygons like rectangles, parallelograms, and quadrilateral kites.

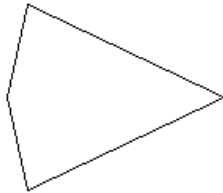
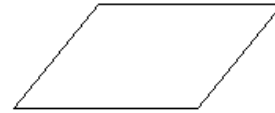
Next, I present several of Escher's tessellations, each generated by its own unique modifying rule or rules. Each student is provided with a set of corresponding worksheets, and instructed to add the parent polygon as demonstrated with the Pegasus tessellation. [Remember: Join points where **more than two** tessellating shapes meet.] The students study each tessellating shape in its parent polygon, looking for corresponding "bumps" and "holes", and deduce the transformations used to modify the polygon.

In the lizard of Escher's [Tessellation 104](#), a modification to either the top or bottom side of the parent square is rotated 90 degrees to an adjacent side. Each rotation is about a vertex of the square between the related sides, inevitably alternate vertices of the square.



In Escher's [Tessellation 99](#), a modification to one half-side of the parent equilateral triangle is rotated 180 degrees about the midpoint of that side to the adjacent half-side. Then a modification to one of the other sides is rotated 60 degrees to the third side about the vertex between them.

The parent parallelogram of Escher's [Tessellation 75](#) is modified by translation between one pair of parallel sides and by rotation about the midpoint of each of the other sides. In the latter, a modification to one half-side of either side is rotated 180 degrees about the midpoint of that side to the adjacent half-side.



The parent kite-shaped quadrilateral of Escher's [Tessellation 66](#) is modified by glide reflection between two sets of equal and adjacent sides. Each modification is flipped (L/R) and then translated (vertically) to the equal and adjacent side.

The parent parallelogram of Escher's [Tessellation 97](#) is modified by translation between one pair of parallel sides and by glide reflection between the other pair. In the latter, a modification to one side is flipped (L/R) and then translated (vertically) to the equal and opposite side.



As each Escher tessellation is analyzed, one or more examples of similar student artwork is presented. This [Tessellating Rabbit](#) is similar in construction to Escher's lizard of Tessellation 104. The corresponding tessellation appears in the background as a watermark.

Several examples of student tessellating art will be found in my books [Investigating Patterns: Symmetry and Tessellations](#), [Teaching Tessellating Art](#), and [Introduction to Tessellations](#) (co-authored with Dale Seymour). "The" source for color reproductions of all of Escher's tessellations is Doris Schattsneider's definitive book [Visions of Symmetry](#). My [Escher Gallery](#) includes several high resolution reproductions of Escher's tessellations.

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